

# Hydraulics & pneumatics

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Proportional and  
servovalves

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PNEUMATICS IN  
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# The hazy line between servo and proportional valves

By R.T. Schneider, editor emeritus

Thirty years ago, industry was using simple digital directional valves in circuits with relief valves and orifices to control flow and pressure. Servovalves were only considered for the most exacting positioning applications. Proportional valves — although that term was not yet used — were lever-actuated, and relied on the experience and skill of the operator for accuracy. Today there is a wide choice of servo and proportional valves — fueled by the development of the proportional solenoid and the use of closed-loop position control — that allows machine builders to obtain greater and greater accuracy levels. A new range of valves with on-board, high-current, PWM drivers can meet the exact performance and cost requirements of almost any application.

Valves can be classified as servo, proportional, and servo-proportional, based on performance expectations. Traditionally, the term servovalve describes valves that use closed-loop control. These valves monitor and feed the main-stage spool position back to the pilot stage or driver, either mechanically or electronically. They can come in several designs, such as nozzle flapper and jet pipe, which are differentiated from one another by the type of hydraulic bridge.

Proportional valves displace the main-stage spool proportionally to a command signal, but they normally do not have means of automatic error correction (feedback) within the valve. Typically, proportional valves displace the spool by driving it against a set of balanced springs.

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**Valve technology, both servo and proportional, has evolved with changing demands of industrial designers. Perhaps it's time to toss out the traditional definitions.**

These springs serve to center the spool and achieve proportionality between input current and spool displacement. Proportional valves are usually considered to have lower response and less repeatability than servovalves.

There is also a category of servo-proportional valves that incorporates closed-loop spool-position feedback to increase repeatability and accuracy for critical applications. In this category are direct-drive valves, which displace the spool by physically linking it to the motor armature that moves it, with a position transducer to provide spool-position feedback. Typically, servo-proportional direct-drive valves have an overall lower dynamic response than hydraulically piloted 2-stage valves with the same flow characteristics. A major advantage of this design is that valve performance does not vary when supply pressure changes.

The distinction between servovalves and proportional valves is complex. Pinpointing this distinction has become increasingly difficult. Technological innovations have improved response characteristics of proportional valves, making them perform more like servovalves. Servovalves also act like proportional valves because spool displacement and flow are directly proportional to the input command. In addition, all of the designs discussed can be used to create a multistage hydraulic valve, further confusing the distinctions. Eventually, the line between these two technologies will disappear as manufacturers focus on electronic-feedback valves and develop proportional valves that can do the work traditionally dominated by servovalves.

Clearly, the choices and considerations when selecting a valve are many and varied. The important consideration is not a definition, but the selection of the right valve for the application. Some important questions to ask are:

- What are the performance requirements?
- In what environment will the valve be used?
- What are the troubleshooting and diagnostic needs?

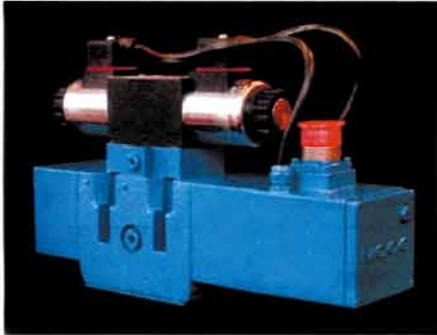
- Are on- or off-board electronics required?
- How critical is this application to the machine's overall performance and quality?
- What are the requirements for accuracy and repeatability? And, of course,
- What are the cost considerations?

There is now on the market a greater variety of types, characteristics, and designs of high-performance valves than ever before. Machine designers can precisely match their need to the exact technology that will meet their requirements. Global improvements in electronics — including smaller sizes and

increasingly affordable performance — suggests that new valve development will focus on digital electronics that can offer plug-and-play implementation, PC-based controls, and self diagnostics. Valves will continue to evolve in the future, but at a faster pace and beyond the traditional definitions.

## Proportional and servovalve product round-up

### Proportional valve



Robust G700 Series proportional directional-control valve achieves controlled acceleration, deceleration, and positioning; incorporates on-board electronics, dual solenoids, fault diagnostics, and main-stage position control. Provides high flow; can be integrated into safety circuits. Comes in four sizes with ISO-standard connections as well as variety of spool configurations. Can be serviced in field.

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